United States
Department of
Agriculture

**Agricultural
Research
Service**

ARS-70

March 1988

A Bibliography of the Flat Grain Beetle, *Cryptolestes pusillus* (Schönherr) (Coleoptera: Cucujidae)

ABSTRACT

Throne, James E. 1988. A Bibliography of the Flat Grain Beetle, Cryptolestes pusillus (Schönherr) (Coleoptera: Cucujidae). U.S. Department of Agriculture, Agricultural Research Service, ARS-70, 16 pp.

Flat grain beetles are pests of stored products throughout most of the world. This bibliography lists 178 papers published about these beetles. Citations are grouped by subject and are indexed by geography, host, and author.

KEYWORDS: Bibliography, Coleoptera, Cryptolestes pusillus, Cucujidae, flat grain beetles, stored-product insects.

CONTENTS

Copies of this publication may be purchased from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

ARS has no additional copies for free distribution.

A Bibliography of the Flat Grain Beetle, Cryptolestes pusillus (Schönherr) (Coleoptera: Cucujidae)

Compiled by James E. Throne

Flat grain beetles, Cryptolestes pusillus (Schönherr) (Coleoptera: Cucujidae), are pests of stored products throughout most of the world. They feed on alfalfa meal, bananas (dried), barley, benniseed, black-eyed peas, cassava, citrus pulp, cocoa, coffee, copra, corn, cottonseed, cowpeas, dates, filberts, gum damar, illipe nuts, kenaf, lentils, milk powder, millet, Nere seed, nutmeg, oats, palm kernels, peaches, peanuts, rice, rye, safflower, sago, seaweed, sorghum, soybeans, sunflower seeds, t'ef, wheat, and yams. Flat grain beetles have been reported in Argentina, Australia, Bangladesh, Barbados, Belize, Brazil, Bulgaria, Burma, Canada, Czechoslovakia, Fiji, Finland, German Democratic Republic, Ghana, Greece, Grenada, Guyana, Hong Kong, India, Indonesia, Iraq, Israel, Jamaica, Japan, Kenya, Malawi, Malaysia, Mexico, Morocco, Mozambique, Nicaragua, Nigeria, People's Republic of China, Philippines, Puerto Rico, Republic of China, Singapore, Soviet Union, Sri Lanka, Sweden, Tanzania, Thailand, Trinidad, Tunisia, Turkey, Uganda, Union of South Africa, United Kingdom, United States of America, Uruguay, Western Samoa, Yugoslavia, and Zimbabwe.

This publication is intended to be a complete bibliography of the flat grain beetle and should assist entomologists in obtaining information on this species. All known articles published since the original description of this species in 1795 through November 1987 have been included here except unpublished theses and dissertations. The genus Cryptolestes generally was not given generic status until 1955 (Lefkovitch 1959); papers published prior to that refer to the genus as Laemophloeus. Olivier originally named the species Cucujus minutus. It was generally referred to as minutus until 1959, when the name pusillus came into general use. Lefkovitch (1959) reviewed the synonymy of the species.

Bibliographic sources consulted were the Review of Applied Entomology - Series A (RAE) for 1965-87, the Bibliography of Agriculture (BA) for 1945-68, and the literature citations in papers. All articles except those followed by a citation in a bibliographic source were available to the compiler. Citations have been divided into general subject areas. Several are listed under more than one subject area.

Research entomologist, Stored-Product Insects Research and Development Laboratory, Agricultural Research Service, U.S. Department of Agriculture, P.O. Box 22909, Savannah, GA 31403.

ATTRACTANTS

MILLAR, J.G., A.C. OEHLSCHLAGER, and J.W. WONG. 1983. Synthesis of two macrolide aggregation pheromones from the flat grain beetle, Cryptolestes pusillus (Schönherr). Journal of Organic Chemistry 48: 4404-4407. [1]

MILLAR, J.G., H.D. PIERCE, Jr., A.M. PIERCE, A.C. OEHLSCHLAGER, J.H. BORDEN, and A.V. BARAK. 1985. Aggregation pheromones of the flat grain beetle, Cryptolestes pusillus (Coleoptera: Cucujidae). Journal of Chemical Ecology 11: 1053-1070. [2]

OEHLSCHLAGER, A.C., G.G.S. KING, H.D. PIERCE, Jr., A.M. PIERCE, K.N. SLESSOR, J.G. MILLAR, and J.H. BORDEN. 1987. Chirality of macrolide pheromones of grain beetles in the genera Oryzaephilus and Cryptolestes and its implications for species specificity. Journal of Chemical Ecology 13: 1543-1554. [3]

SAKAI, T., H. HAMAMOTO, and K. MORI. 1986. New synthesis of macrolide pheromones of the flat grain beetle, Cryptolestes pusillus Schönherr. Agricultural and Biological Chemistry 50: 1621-1627. [4]

BIOLOGY AND ECOLOGY

ARTHUR, B.W. 1956. Insects in stored peanuts and their seasonal abundance. Journal of Economic Entomology 49: 119-120. [5]

ASHBY, K.R. 1961. The life-history and reproductive potential of Cryptolestes pusillus (Schönherr) (Col., Cucujidae) at high temperatures and humidities. Bulletin of Entomological Research 52: 353-361. [6]

BISHOP, G.W. 1959. The comparative bionomics of American Cryptolestes (Coleoptera - Cucujidae) that infest stored grain. Annals of the Entomological Society of America 52: 657-665. [7]

BROWER, J.H. 1973. Reproduction and development of twelve species of stored-product insects on kenaf seed. Florida Entomologist 56: 49-51. [8]

BURGES, H.D., and N.J. BURRELL. 1964. Cooling bulk grain in the British climate to control storage insects and to improve keeping quality. Journal of the Science of Food and Agriculture 1: 32-50. [9]

CLINE, L.D., and H.A. HIGHLAND. 1981. Minimum size of holes allowing passage of stored-product Coleoptera. Journal of the Georgia Entomological Society 16: 525-531. [10]

COTTON, R.T., and T.F. WINBURN. 1941. Field infestation of wheat by insects attacking it in farm storage. Journal of the Kansas Entomological Society 14: 12-16. [11]

CURRIE, J.E. 1967. Some effects of temperature and humidity on the rates of development, mortality and oviposition of Cryptolestes pusillus (Schönherr) (Coleoptera, Cucujidae). Journal of Stored Products Research 3: 97-108. [12]

DAVIES, R.G. 1949. The biology of Laemophloeus minutus Oliv. (Col. Cucujidae). Bulletin of Entomological Research 40: 63-82. [13]

DOUGLAS, W.A. 1941. Field infestation by insects that injure rice in storage. United States Department of Agriculture Circular 602, 8 pages. [14]

FLANDERS, S.E. 1930. Mass production of egg parasites of the genus Trichogramma. Hilgardia 4: 465-501. [15]

FLOYD, E.H., A.D. OLIVER, and J.D. POWELL. 1959. Damage to corn in Louisiana caused by stored-grain insects. Journal of Economic Entomology 52: 612-615. [16]

FREEMAN, J.A. 1962. The influence of climate on insect populations of flour mills. Pages 301-308 in Proceedings of the XI International Congress of Entomology, Vienna, 1960, Volume 2. [17]

GILES, P.H. 1969. Observations in Kenya on the flight activity of stored products insects, particularly Sitophilus zeamais Motsch. Journal of Stored Products Research 4: 317-329. [18]

GILL, W.S., and R.G. STRONG. 1964.

Development of stored-product insects on safflower seeds and meal. Journal of Economic Entomology 57: 917-920. [19]

GIRISH, G.K. 1965. Effect of temperature on the development of stored grain insect pests. Bulletin of Grain Technology 3: 142-154. [20]

HOWE, R.W. 1943. An investigation of the changes in a bin of stored wheat infested by insects. Bulletin of Entomological Research 34: 145-158. [21]

HSIU, C.S. 1936. The interrelation of self-heating of stored grain and granary pests [in Chinese]. Entomology and Phytopathology 4: 80-83. (RAE 24: 807) [22]

KENAGA, E.E., and F.W. FLETCHER. 1942. Effects of high temperature on several household and storage grain pests. Journal of Economic Entomology 35: 944. [23]

KOKUBU, H., and R.B. MILLS. 1980. Susceptibility of thirteen stored product beetles to entanglement by Trogoderma hastisetae. Journal of Stored Products Research 16: 87-92. [24]

LECATO, G.L. 1974. Increase in populations of Cryptolestes pusillus and C. turcicus on diets of natural products. Florida Entomologist 57: 309-312. [25]

LECATO, G.L. 1975. Interactions among four species of stored-product insects in corn: a multifactorial study. Annals of the Entomological Society of America 68: 677-679. [26]

LECATO, G.L. 1975. Species composition influencing insect population growth and weight loss of stored rice, wheat, and corn. Journal of the Kansas Entomological Society 48: 224-231. [27]

LEFKOVITCH, L.P. 1963. Differing status of colour forms in Cryptolestes Gangl. (Cucujidae). Tribolium Information Bulletin 6: 45-46. [28]

LEFKOVITCH, L.P. 1964. The biology of Cryptolestes pusilloides (Steel & Howe) (Coleoptera, Cucujidae), a pest of stored cereals in the Southern Hemisphere. Bulletin of Entomological Research 54: 649-656. [29]

LEFKOVITCH, L.P. 1965. The Cryptolestes (Gangl.) (Col.: Cucujidae) occurring in stored food [Abstract]. Page 622 in Proceedings of the XII International Congress of Entomology, London, 8-16 July, 1964. [30]

LEFKOVITCH, L.P., and J.E. CURRIE. 1967. Some morphological, biological and genetical differences between Cryptolestes pusillus fuscus ssp.n. and C. pusillus pusillus (Schönherr) (Coleoptera, Cucujidae). Journal of Stored Products Research 3: 311-320. [31]

LINSLEY, E.G. 1944. Natural sources, habitats, and reservoirs of insects associated with stored food products. Hilgardia 16: 187-224 [32]

LOSCHIAVO, S.R. 1959. Observations on food preferences of five species of stored-product insects. Cereal Chemistry 36: 299-307. [33]

LUCAS, C.E., and T.A. OXLEY. 1946. Study of an infestation by Laemophloeus sp. (Coleoptera Cucujidae) in bulk wheat. Annals of Applied Biology 33: 289-293. [34]

MCFARLANE, J.A., and P. DOBIE. 1972. The susceptibility of t'ef (Eragrostis abyssinica Schrad.) to infestation by some insect pests of stored grain. Journal of Stored Products Research 8: 177-182. [35]

MCGAUGHEY, W.H., R.A. KINSINGER, and E.B. DICKE. 1975. Dispersal of Bacillus thuringiensis spores by nonsusceptible species of stored-grain beetles. Environmental Entomology 4: 1007-1010. [36]

PAJNI, H.R., and K.M. GILL. 1974. Effect of light on the pests of stored products. Bulletin of Grain Technology 12: 151-153. (RAE 64: 3782) [37]

PAYNE, N.M. 1946. Life history and habits of the flat grain beetle (Laemophloeus minutus Oliv.). Journal of the New York Entomological Society 54: 9-12. [38]

RILETT, R.O., and R.D. WEIGEL. 1956. A winter survey of Coleoptera in feed and flour mills. Journal of Economic Entomology 49: 154-156. [39]

RODRIGUEZ, J.G., M. POTTS, and L.D. RODRIGUEZ. 1979. Survival and reproduction of two species of stored product beetles on selected fungi. Journal of Invertebrate Pathology 33: 115-117. [40]

SARID, J.N., L. RAI, and S.V. PINGALE. 1967. Studies on the large scale storage of food grain in India. Part III. Studies on the insect and temperature fluctuations in bag storage of wheat. Bulletin of Grain Technology 5: 3-11. [41]

SIKOROWSKI, P.P. 1964. Interrelation of fungi and insects to deterioration of stored grains. Washington Agricultural Experiment Station Technical Bulletin 42, 35 pages. [42]
SINCLAIR, E.R., and J. ALDER. 1984. Migration of stored-grain insect pests from a small wheat bulk. Australian Journal of Experimental Agriculture and Animal Husbandry 24: 260-266. [43]
SINHA, R.N., D. WATERER, and W.E. MUIR. 1986. Carbon dioxide concentrations associated with insect infestations of stored grain. 1. Natural infestation of corn, barley and wheat in farm granaries [not seen]. Sciences des Aliments 6: 91-98. [44]
SOLOMON, M.E., and B.E. ADAMSON. 1955. The powers of survival of storage and domestic pests under winter conditions in Britain. Bulletin of Entomological Research 46: 311-355. [45]
SRDIC, Z. 1974. Colonization of the nests of the pupae of the mealy moth Anagasta kuehniella Zell. (Lep. Pyralidae) [in Polish]. Zastita Bilja 25: 65-69. [46]
WILLIAMS, G.C. 1954. Observations on the effect of exposure to a low temperature on Laemophloeus minutus (Ol.) (Col. Cucujidae). Bulletin of Entomological Research 45: 351-359. [47]
WILLIAMS, G.C. 1954. Observations on the life history of Laemophloeus minutus (Ol.) (Col. Cucujidae) when bred on various stored cereals and cereal products. Bulletin of Entomological Research 45: 341-349. [48]
WOJCIK, D.P. 1968. Tests for audible and ultrasonic sound production by stored-product insects. Journal of Economic Entomology 61: 1414-1417. [49]
WOJCIK, D.P. 1969. Mating behavior of 8 stored-product beetles (Coleoptera: Dermestidae, Tenebrionidae, Cucujidae, and Curculionidae). Florida Entomologist 52: 171-197. [50]
WOJCIK, D.P. 1969. Monitoring for audible and ultrasonic sound production by stored-product insects during mating. Journal of Economic Entomology 62: 937. [51]
WRIGHT, V.F., and R. BURROUGHS. 1983. Mold-damaged grain sorghum as a diet for three stored-grain beetles (Coleoptera). Environmental Entomology 12: 558-560. [52]
YADAV, T.D., and S. SINGH. 1985. Host-suitability of lentil for eight stored product insects. LENS Newsletter 12: 27-28. [53]
YOSHIDA, T. 1975. Milk powder preferences of insects infesting stored products [in Japanese, English summary]. Journal of the Food Hygienic Society of Japan 16: 74-79. [54]
YOSHIDA, T., and K. KAWANO. 1958. Seasonal fluctuation of the number of insects in the grains stored at farm-house. The ecological studies of the pests infesting stored grains. Part 2 [in Japanese, English summary]. Memoirs of the Faculty of Liberal Arts and Education, Miyazaki University, Natural Science 5: 11-23. [55]
YOSHIDA, T., and K. KAWANO. 1959. Fauna and community structure of the insects in the grain stored at farm-houses. The ecological studies of the pests infesting stored grains. Part 3 [in Japanese, English summary]. Memoirs of the Faculty of Liberal Arts and Education, Miyazaki University, Natural Science 7: 33-61. [56]
ZDARKOVA, E., P.H. VERNER, and J. NOVOSAD. 1983. Dispersion and distribution of mites and beetles in stored grain. Journal of Stored Products Research 19: 73-80. [57]

CONTROL

Chemical

BANG, Y.H., and E.H. FLOYD. 1962. Effectiveness of malathion in protecting stored polished rice from damage by several species of stored-grain insects. Journal of Economic Entomology 55: 188-190. [58]
DOHAREY, R.B., A. KUMAR, and B.K. VARMA. 1981. Results of field trials with pirimiphos methyl 50% EC against stored grain insect pests. Pesticides 15(11): 7-11. (RAE 70: 5624) [59]
KUMAR, A., G.P. PANDEY, R.B. DOHAREY, and B.K. VARMA. 1982. Field trials with some newer organophosphatic insecticides against insect pests of stored foodgrains. Pesticides 16(1): 7-10, 13. (RAE 70: 6750) [60]

LAHUE, D.W. 1965. Evaluation of malathion, synergized pyrethrum, and diatomaceous earth as wheat protectants...in small bins. U.S. Department of Agriculture, Agricultural Research Service, Marketing Research Report 726, 13 pages. [61]

LAHUE, D.W. 1975. Evaluating Gardona and malathion to protect wheat in small bins against stored-grain insects. U.S. Department of Agriculture, Agricultural Research Service, Marketing Research Report 1037, 12 pages. [62]

LAHUE, D.W., and E.B. DICKE. 1976. Evaluating selected protectants for shelled corn against stored-grain insects. U.S. Department of Agriculture, Agricultural Research Service, Marketing Research Report 1058, 9 pages. [63]

LAHUE, D.W., and E.B. DICKE. 1977. Evaluation of selected insecticides applied to high moisture sorghum grain to prevent stored grain insect attack. U.S. Department of Agriculture, Agricultural Research Service, Marketing Research Report 1063, 10 pages. [64]

LAUDANI, H., H.B. GILLENWATER, B.H. KANTACK, and M.F. PHILLIPS. 1959. Protection of citrus pulp against insect infestation with surface applications of pyrethrum-piperonyl butoxide wettable powder. Journal of Economic Entomology 52: 224-227. [65]

PRADHAN, S., and P. SARUP. 1960. Relative toxicity of insecticidal films to adults of Trogoderma granarium Everts., Oryzaephilus surinamensis Linn. & Laemophloeus minutus Oliv. Journal of Scientific and Industrial Research 19C (6): 135-139. (BA 24: 94199) [66]

QUINLAN, J.K. 1972. Malathion aerosols applied in conjunction with aeration to corn stored in a flat storage structure. Proceedings of the North Central Branch of the Entomological Society of America 27: 63-65. [67]

RAMZAN, M., R.P. CHAWLA, and B.S. CHAHAL. 1986. Efficacy of pre-harvest application of some insecticides on wheat for post-harvest protection against storage-pests. Pesticides 20(7): 50-51. [68]

SINCLAIR, E.R., and M. BENGSTON. 1980. The frequency of Cryptolestes spp. in grain in south-east Queensland. Australian Journal of Experimental Agriculture and Animal Husbandry 20: 234-239. [69]

SRIVASTAVA, A.S., and J.L. SRIVASTAVA. 1970. Residual toxicity of lindane and malathion against Laemphloeus minutus Oliv. Zeitschrift für Angewandte Entomologie 66: 100-102. (RAE 61: 1456) [70]

STRONG, R.G., D.E. SBUR, and G.J. PARTIDA. 1967. The toxicity and residual effectiveness of malathion and diazinon used for protection of stored wheat. Journal of Economic Entomology 60: 500-505. [71]

TSVETKOV, D. 1963. The preparation Alodan 5% tested for the control of some granary pests by dusting wheat grain [in Bulgarian, English summary]. Izvestiya na Instituta za Zashtitana Rasteniyata 5: 163-169. (RAE 53: 485-486) [72]

WATTERS, F.L. 1956. Pyrethrins - piperonyl butoxide as a residual treatment against insects in elevator boots. Cereal Chemistry 33: 145-150. (BA 20: 51771) [73]

YADAV, T.D. 1980. Toxicity of DDT and lindane against thirteen species of stored product insects. Indian Journal of Entomology 42: 671-674. (RAE 69: 7414) [74]

Fumigation

BACK, E.A., and R.T. COTTON. 1924. Effect of fumigation upon heating of grain caused by insects. Journal of Agricultural Research 28: 1103-1116. [75]

HOLE, B.D., C.H. BELL, K.A. MILLS, and G. GOODSHIP. 1976. The toxicity of phosphine to all developmental stages of thirteen species of stored product beetles. Journal of Stored Products Research 12: 235-244. [76]

LEFKOVITCH, L.P. 1965. Differences between six species of Cryptolestes (Coleoptera, Cucujidae) in susceptibility to methyl bromide vapour. Bulletin of Entomological Research 56: 197-200.[77]

NI, Z.Z. 1984. Fumigation trials with carbon disulphide:carbon tetrachloride (20:80) in silo bins. Pages 657-662 in B.E. Ripp, editor, Controlled atmosphere and fumigation in grain storages. Proceedings of an international sympo-

sium "Practical aspects of controlled atmosphere and fumigation in grain storages" held from 11 to 22 April 1983 in Perth, Western Australia. [78]
PINGALE, S.V., L. RAI, J.N. SARID, and I.P. KAPOOR. 1963. Fumigation of food grains in India with hydrogen phosphide. Series II. Rail-wagons fumigated in transit. Bulletin of Grain Technology 1: 43-49. [79]
RAI, L., J.N. SARID, and S.V. PINGALE. 1963. Fumigation of food grains in India with hydrogen phosphide. Series I. Tests in concrete bins. Bulletin of Grain Technology 1: 3-17. [80]
RILEY, J. 1970. The fumigation of large cocoa stacks in a specially designed cocoa warehouse using phosphine. Part 2. Pages 17-22 in Annual Report of the Nigerian Stored Products Research Institute 1969. [81]
SOEKARNA, D., and D. KILIN. 1981. Research activities on storage insects at CRIA. Pages 127-139 in Pests of stored products. Proceedings of BIOTROP symposium on pests of stored products, Bogor, Indonesia, 24-26 April, 1978. (RAE 71: 5862) [82]

Miscellaneous

BROWER, J.H., and P.G. MAHANY. 1973. Gamma radiation sensitivity of the cadelle, Tenebroides mauritanicus (Coleoptera: Ostomidae) and the flat grain beetle, Cryptolestes pusillus (Coleoptera: Cucujidae). Journal of the Georgia Entomological Society 8: 174-184. [83]
CARLSON, S.D., and H.J. BALL. 1962. Mode of action and insecticidal value of a diatomaceous earth as a grain protectant. Journal of Economic Entomology 55: 964-970. [84]
DOANE, R.W. 1919. Weevils in Australian wheat in California. Journal of Economic Entomology 12: 308-312. [85]
DUNKEL, F.V., and N.R. READ. 1986. Sorbic acid as a long-term protectant in stored corn. Journal of Economic Entomology 79: 805-812. [86]
KIRKPATRICK, R.L., and A. CAGLE. 1978. Controlling insects in bulk wheat with infrared radiation. Journal of the Kansas Entomological Society 51: 386-393. [87]
LAHUE, D.W. 1965. Evaluation of malathion, synergized pyrethrum, and diatomaceous earth as wheat protectants...in small bins. U.S. Department of Agriculture, Agricultural Research Service, Marketing Research Report 726, 13 pages. [88]
MAJUMDER, S.K., and A. BANO. 1964. Toxicity of calcium phosphate to some pests of stored grain. Nature 202: 1359-1360. [89]
PATOUREL, G.N.J. LE. 1986. The effect of grain moisture content on the toxicity of a sorptive silica dust to four species of grain beetle. Journal of Stored Products Research 22: 63-69. [90]
PERSON, N.K., Jr., and J.W. SORENSON, Jr. 1970. Use of gaseous nitrogen for controlling stored-product insects in cereal grains. Cereal Chemistry 47: 679-686. [91]
PRESS, J.W., R.H. PHILLIPS, P.T.M. LUM, and A.M. MILLER. 1972. Tricalcium phosphate as an additive to CSM and all-purpose wheat flour for control of insect infestations. Journal of Economic Entomology 65: 254-257. [92]
WHITE, G.D., W.L. BERNDT, and J.L. WILSON. 1975. Evaluating diatomaceous earth, silica-aerogel dusts, and malathion to protect stored wheat from insects. U.S. Department of Agriculture, Agricultural Research Service, Marketing Research Report 1038, 18 pages. (RAE 64: 5709) [93]
YOSHIDA, T. 1975. Nitrogen atmosphere and pest insects [in Japanese]. Journal of the Food Hygienic Society of Japan 16: 1-11. [94]

Natural Enemies

CHATTERJI, S., P. SARUP, and M.G.R. MENON. 1961. Biological observations on Palorus shikhae Sarup, Chatterji & Menon, a predator of some stored cereal pests. Indian Journal of Entomology 23: 241-243. [95]
COTTON, R.T., and N.E. GOOD. 1937. Annotated list of the insects and mites associated with stored grain and cereal products, and of their arthropod parasites and predators. U.S. Department of Agriculture Miscellaneous Publication 258, 81 pages. [96]
FINLAYSON, L.H. 1950. Host preference

of Cephalonomia waterstoni Gahan, a bethylid parasitoid of Laemophloeus species. Behaviour 2: 275-315. [97]
FINLAYSON, L.H. 1950. Mortality of Laemophloeus (Coleoptera, Cucujidae) infected with Mattesia dispora Naville (Protozoa, Schizogregarinaria). Parasitology 40: 261-264. [98]
FINLAYSON, L.H. 1952. Host selection by Cephalonomia waterstoni Gahan (Hym. Bethylidae). Pages 370-374 in Proceedings of the Ninth International Congress of Entomology. Volume 1. [99]
GAHAN, A.B. 1931. On certain hymenopterous parasites of stored-grain insects. Journal of the Washington Academy of Sciences 21: 213-221. [100]

Packaging

CLINE, L.D. 1978. Penetration of seven common flexible packaging materials by larvae and adults of eleven species of stored-product insects. Journal of Economic Entomology 71: 726-729. [101]
CLINE, L.D., and H.A. HIGHLAND. 1976. Clinging and climbing ability of adults of several stored-product beetles on flexible packaging materials. Journal of Economic Entomology 69: 709-710. [102]
HIGHLAND, H.A. 1975. Insect resistance of composite cans. U.S. Department of Agriculture, Agricultural Research Service, ARS-S-74, 4 pages. [103]
HIGHLAND, H.A., L.D. CLINE, and R.A. SIMONAITIS. 1977. Insect-resistant food pouches made from laminates treated with synergized pyrethrins. Journal of Economic Entomology 70: 483-485. [104]
HIGHLAND, H.A., M. SECREAST, and D.A. YEADON. 1975. Insect-resistant textile bags: new construction and treatment techniques. U.S. Department of Agriculture, Agricultural Research Service, Technical Bulletin 1511, 12 pages. [105]

DAMAGE TO STORED PRODUCTS

KHARE, B.P., K.N. SINGH, R.N. CHAUDHARY, C.S. SENGAR, R.K. AGRAWAL, and P.N. RAI. 1974. Insect infestation and quality deterioration of grain - I. Germination, odour and palatability in wheat. Indian Journal of Entomology 36: 194-199. [106]
RAJU, P. 1984. The staggering storage losses - causes and extent. Pesticides 18: 35-37. (RAE 73: 457) [107]

DETECTION AND SAMPLING

BARAK, A.V., and P.K. HAREIN. 1982. Trap detection of stored-grain insects in farm-stored, shelled corn. Journal of Economic Entomology 75: 108-111. [108]
BRUCE, W.A., M.W. STREET, R.C. SEMPER, and D. FULK. 1982. Detection of hidden insect infestations in wheat by infrared carbon dioxide gas analysis. U.S. Department of Agriculture, Agricultural Research Service, Advances in Agricultural Technology, Southern Series AAT-S-26, 8 pages. [109]
MEAGHER, R.L., Jr., R.B. MILLS, and R.M. RUBISON. 1986. Comparison of pneumatic and manual probe sampling of Kansas farm-stored grain sorghum. Journal of Economic Entomology 79: 284-288. [110]
SODERSTROM, E.L. 1970. Phototactic response of stored-product insects to various intensities of ultra-violet light. Journal of Stored Products Research 6: 275-277. [111]
STERMER, R.A. 1959. Spectral response of certain stored-product insects to electromagnetic radiation. Journal of Economic Entomology 52: 888-892. [112]
WRIGHT, V.F., and R.B. MILLS. 1984. Estimation of stored-product insect populations in small bins using two sampling techniques. Pages 672-679 in Proceedings of the Third International Working Conference on Stored-Product Entomology, October 23-28, 1983, Kansas State University, Manhattan, Kansas, USA. [113]

GENERAL PAPERS

DOUGHTON, J.A. 1974. Grain sorghum in the Northern Territory. Department of the Northern Territory, Animal Industry and Agriculture Branch, Darwin, Australia, Technical Bulletin 13, 115 pages. (RAE 63: 3145) [114]
FABER, W. 1962. The little grain beetle and the rusty and flat grain beetle, two abundant secondary pests of stored

grain [in German]. Pflanzenarzt 15: 106-108. (BA 27: 83973) [115]

MATHLEIN, R. 1968. Main stored products problems in Sweden. Pages 55-56 in Report of the International Conference on the Protection of Stored Products (Lisbon-Oeiras, November 27-30, 1967). European and Mediterranean Plant Protection Organization Publication (Series A) 46E, 171 pages. (RAE 58: 41) [116]

MORPHOLOGY

PAJNI, H.R., and A. BEDI. 1974. Male genitalia of Oryzaephilus mercator Fauv. and Laemophloeus pusillus Schon. with some remarks on these organs in family Cucujidae (Coleoptera). Indian Journal of Entomology 36: 28-30. [117]

REID, J.A. 1942. The relative sizes of different parts in beetles of the genus Laemophloeus. Proceedings of the Royal Entomological Society of London, Series A 17: 19-26. [118]

REARING

APT, A.C. 1950. A method of rearing the flat grain beetle and the grain mite. Journal of Economic Entomology 43: 735. [119]

YOSHIDA, T. 1975. Rearing twelve coleopterous species and one psocid infesting cereal products on milk powder [in Japanese, English summary]. Journal of the Food Hygienic Society of Japan 16: 80-84. [120]

SURVEYS

ADESUYI, S.A. 1966. A survey of insect pests on stored dried yam and an investigation of the biology of the important species. Pages 95-99 in Annual Report of the Nigerian Stored Products Research Institute 1965. [121]

BAHR, I., and W. PRINZ. 1977. Insects in stored grain in the German Democratic Republic and the prevention of damage [in German, English summary]. Nachrichtenblatt für den Pflanzenschutz in der DDR 31: 200-204. (RAE 66: 3259) [122]

BARAK, A.V., and P.K. HAREIN. 1981. Insect infestation of farm-stored shelled corn and wheat in Minnesota. Journal of Economic Entomology 74: 197-202. [123]

BISSELL, T.L., and M. DUPREE. 1946. Insects in shelled peanuts in relation to storage and bagging. Journal of Economic Entomology 39: 550-552. [124]

CALDERON, M., and E. DONAHAYE. 1964. Records on the occurrence and hosts of stored product insects in Israel. Rivista di Parassitologia 25: 55-68. [125]

CHAMP, B.R. 1965. An investigation of peanut storage pests in Queensland. 1. Introduction, species and pest status. Queensland Journal of Agricultural and Animal Sciences 22: 227-240. [126]

COOMBS, C.W., and J.A. FREEMAN. 1955. The insect fauna of an empty granary. Bulletin of Entomological Research 46: 399-417. [127]

DAVIES, J.C. 1960. Coleoptera associated with stored products in Uganda. East African Agricultural Journal 25: 199-201. [128]

DAVIES, J.C. 1960. Experiments on the crib storage of maize in Uganda. East African Agricultural and Forestry Journal 25: 71-75. [129]

DHALIWAL, G.S. 1976. Intensity of insect infestation under rural storage conditions in the Punjab. Entomologists' Newsletter 6: 49-50. (RAE 65: 6284) [130]

DHALIWAL, G.S. 1977. Incidence of storage insect pests in rural areas. Indian Journal of Entomology 39: 114-116. [131]

DUNKEL, F.V., Z.L. PU, and L. CHUAN. 1985. Wheat grain storage by rural producers in southern China. Tropical Science 25: 103-115. [132]

EDEN, W.G. 1967. Insect damage to corn in three southeastern states at time of harvest and in farm storage. U.S. Department of Agriculture, Agricultural Research Service, Marketing Research Report 792, 9 pages. [133]

EL-HAIDARI, H.S., H.M. AL-SAUD, M. AL-BANNA, M.A. FAWZIA, and A. KHUTHAIR. 1981. New records of insects attacking date palms treated with growth regulators in Iraq. Date Palm Journal 1: 134-135. (RAE 70: 3972) [134]

GILES, P.H. 1964. The insect infestation of sorghum stored in granaries in northern Nigeria. Bulletin of Entomo-

logical Research 55:573-587. [135]
GILES, P.H., and O. LEON. 1974. Infestation problems in farm-stored maize in Nicaragua. Pages 68-76 in Proceedings of the First International Working Conference on Stored-Product Entomology, Savannah, Georgia, USA, October 7-11, 1974. [136]
GOULD, G.E. 1948. Insect-problems in corn processing plants. Journal of Economic Entomology 41: 774-778. [137]
HEAPE, R.J. 1969. Some aspects of the insect infestation on stored benniseed. Pages 81-85 in Annual Report of the Nigerian Stored Products Research Institute 1968. [138]
HERFORD, G.M. 1939. Common pests of grain godowns in Hong Kong. Hong Kong Naturalist 9: 102-107. [139]
HODGES, R.J., W.R. DUNSTAN, I. MAGAZINI, and P. GOLOB. 1983. An outbreak of Prostephanus truncatus (Horn) (Coleoptera: Bostrichidae) in East Africa. Protection Ecology 5: 183-194. [140]
HORTON, P.M. 1982. Stored product insects collected from on-farm storage in South Carolina. Journal of the Georgia Entomological Society 17: 485-491. [141]
HOWE, R.W., and L.P. LEFKOVITCH. 1957. The distribution of the storage species of Cryptolestes (Col., Cucujidae). Bulletin of Entomological Research 48: 795-809. [142]
HURLOCK, E.T. 1963. The infestation of Canadian produce inspected in United Kingdom ports between 1953 and 1959. Canadian Entomologist 95: 1263-1284. [143]
LAHUE, D.W., B.W. CLEMENTS, Jr., and H. WOMACK. 1959. Insect infestation as a factor in storing farmers stock peanuts grown in Georgia. U.S. Department of Agriculture Marketing Research Report 364, 39 pages. [144]
LEVER, R.J.A.W. 1943. Entomological notes. Agricultural Journal, Fiji 14: 14-18. [145]
MOOKHERJEE, P.B., M.G. JOTWANI, P. SIRCAR, and T.D. YADAV. 1968. Studies on the incidence and extent of damage due to insect pests in stored seeds. - 1. Cereal seeds. Indian Journal of Entomology 30: 61-65. (RAE 58: 304) [146]
MORRISON, E.O. 1964. A survey on the distribution of the rice weevil complex, Sitophilus spp., infesting stored grain in Texas and a check-list of other stored grain insect pests encountered. Texas Journal of Science 16: 90-95. [147]
O'FARRELL, A.F., and P.M. BUTLER. 1948. Insects and mites associated with the storage and manufacture of foodstuffs in northern Ireland. Royal Dublin Society Economic Proceedings 3: 343-407. [148]
OKOBI, A.O. 1978. A study of the effect of 5 months storage on bagged cocoa in a 1,250 ton stack. Pages 13-15 in Annual Report of the Nigerian Stored Products Research Institute 1975-76. (RAE 69: 1446) [149]
OLSEN, A.R. 1981. List of stored-product insects found in imported foods entering United States at southern California ports. Bulletin of the Entomological Society of America 27: 18-20. [150]
RICHARDS, O.W., and G.V.B. HERFORD. 1930. Insects found associated with cacao, spices and dried fruits in London warehouses. Annals of Applied Biology 17: 367-395. [151]
SALMOND, K.F. 1956. The insect and mite fauna of a Scottish flour mill. Bulletin of Entomological Research 47: 621-630. [152]
SCHWITZGEBEL, R.B., and H.H. WALKDEN. 1944. Summer infestation of farm-stored grain by migrating insects. Journal of Economic Entomology 37: 21-24. [153]
SINCLAIR, E.R., and M. BENGSTON. 1980. The frequency of Cryptolestes spp. in grain in south-east Queensland. Australian Journal of Experimental Agriculture and Animal Husbandry 20: 234-239. [154]
SMITH, L.B. 1975. Occurrence of the depressed flour beetle, Palorus subdepressus (Coleoptera: Tenebrionidae), in Canada. Canadian Entomologist 107: 109. [155]
SMITH, L.B., and P.S. BARKER. 1987. Distribution of insects found in granary residues in the Canadian prairies. Canadian Entomologist 119: 873-880. [156]
SOEKARNA, D., and D. KILIN. 1981. Research activities on storage insects at CRIA. Pages 127-139 in Pests of stored

products. Proceedings of BIOTROP symposium on pests of stored products, Bogor, Indonesia, 24-26 April, 1978. (RAE 71: 5862) [157]
SONDA, M. 1970. Distribution of Cryptolestes of stored products in Kyushu (Col., Cucujidae) [in Japanese, English summary]. Proceedings of the Association for Plant Protection of Kyushu 16: 85-86. (RAE 61: 4045) [158]
SRIVASTAVA, A.S., and J. LAL. 1967. Survey of stored product insects in various godowns in Kanpur, Azamgarh, Mathura, Allahabad, Varanasi, Bareilly and Budaun. Labdev Journal of Science and Technology 5: 165-166. (RAE 57: 2162) [159]
TREHAN, K.N., and S.V. PINGLE. 1948. Insect pests of stored grains in Bombay godowns. Current Science 17: 128.[160]
UICHANCO, L.B., and S.R. CAPCO. 1934. Effect of various methods of storing corn on the degree of damage due to weevils. Philippine Agriculturist 22: 653-672. [161]
WINBURN, T.F. 1940. Insect infestation in farm-stored grain in Kansas. Transactions of the Kansas Academy of Science 43: 289-290. [162]
WINBURN, T.F. 1941. Insect infestation in railway box cars in which wheat has been shipped. Journal of the Kansas Entomological Society 14: 22-25. [163]

TAXONOMY

BANKS, H.J. 1979. Identification of stored product Cryptolestes spp. (Coleoptera: Cucujidae): a rapid technique for preparation of suitable mounts. Journal of the Australian Entomological Society 18: 217-222. [164]
BIEGE, C.R., and G.J. PARTIDA. 1976. Taxonomic characters to identify three species of Cryptolestes (Coleoptera: Cucujidae). Journal of the Kansas Entomological Society 49: 161-164.[165]
BISHOP, G.W. 1960. Taxonomic observations on the larvae of the three American Cryptolestes (Coleoptera: Cucujidae) that infest stored grain. Annals of the Entomological Society of America 53: 8-11. [166]
BRÄUER, G. 1970. The importance of flat grain beetles (Cryptolestes Gangl.; Coleopt.; Cucujidae) in the storage of grain and grain products [in German, English summary]. Nachrichtenblatt für den Deutschen Pflanzenschutzdienst 24: 216-222. (RAE 61: 3472) [167]
GREEN, M. 1979. Cryptolestes klapperichi Lefkovitch in stored products and its identification (Coleoptera: Cucujidae). Journal of Stored Products Research 15: 71-72. [168]
HOSSAIN, M., P.H. VERNER, and R. REZAUR. 1986. Taxonomic descriptions of the mature larvae of six species of Cryptolestes (Coleoptera: Cucujidae). Bangladesh Journal of Zoology 14: 139-148. (RAE 75: 3063) [169]
JOY, N.H. 1932. Coleoptera from a granary at Reading. Entomologists' Monthly Magazine 68: 85. [170]
LEFKOVITCH, L.P. 1959. A revision of the European Laemophloeinae (Coleoptera: Cucujidae). Transactions of the Royal Entomological Society of London 111: 95-118. [171]
LEFKOVITCH, L.P. 1962. A revision of African Laemophloeinae. British Museum of Natural History Bulletin 12: 167-245. [172]
OLIVIER, A.G. 1795. Description of Cucujus minutus [not seen]. Entomologie 4: 8-9. [173]
REID, J.A. 1942. The species of Laemophloeus (Coleoptera: Cucujidae) occurring in stored foods in the British Isles. Proceedings of the Royal Entomological Society of London 17: 27-33. [174]
RICHARDS, O.W., and G.V.B. HERFORD. 1930. Insects found associated with cacao, spices and dried fruits in London warehouses. Annals of Applied Biology 17: 367-395. [175]
SENGUPTA, T., P. MUKHOPADHYAY, and R. SENGUPTA. 1978. Economic species of Cryptolestes (Cucujidae: Coleoptera) occurring in India and their control. Bulletin of the Zoological Survey of India 1: 247-252. [176]
STEEL, W.O., and R.W. HOWE. 1952. A new species of Laemophloeus (Col.: Cucujidae) associated with stored products. Proceedings of the Royal Entomological Society of London (B) 21: 86-88. [177]
YABLOKOV-KHNZORYAN, S.M. 1978. Beetles of the tribe Laemophloeini (Coleoptera, Cucujidae) in the Soviet fauna. Commu-

nication 2. Entomological Review 57: 237-249. [English translation of Entomologicheskoye Obozreniye 57: 337-353.] [178]

HOST INDEX